

April 27, 1965

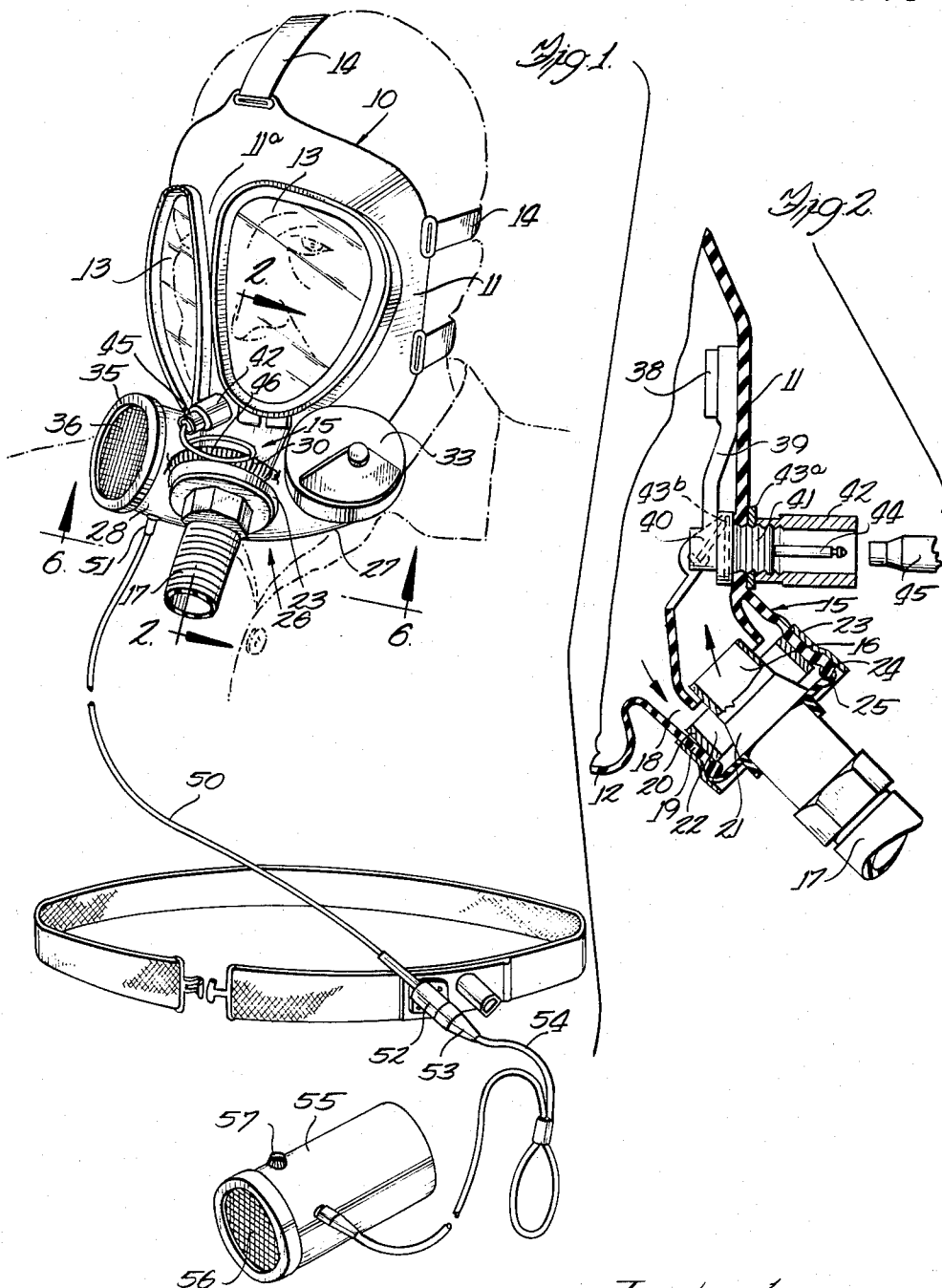
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3,180,333

GAS MASK COMMUNICATION SYSTEM

Filed May 29, 1963

3 Sheets-Sheet 1



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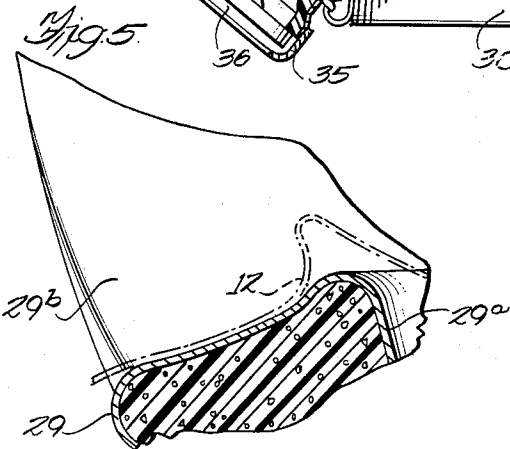
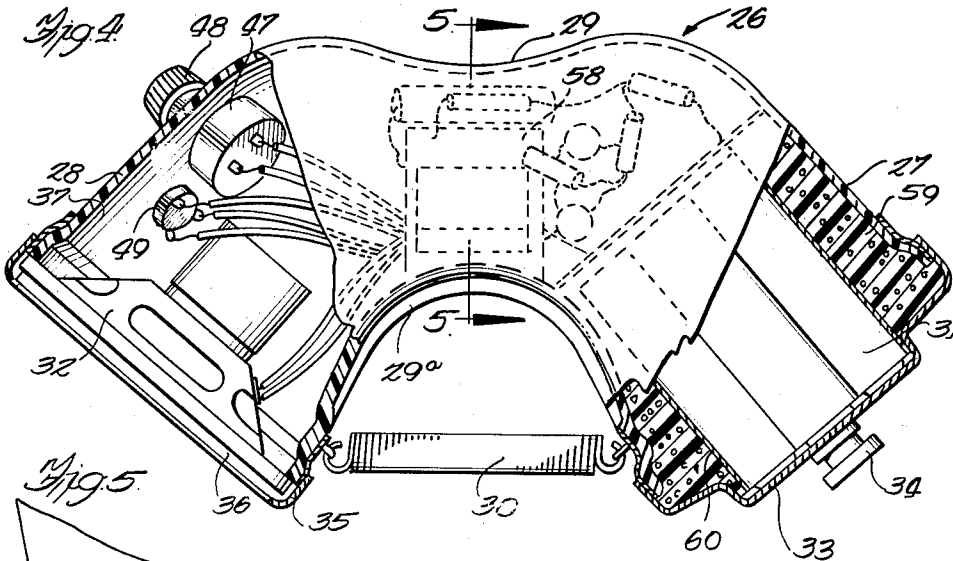
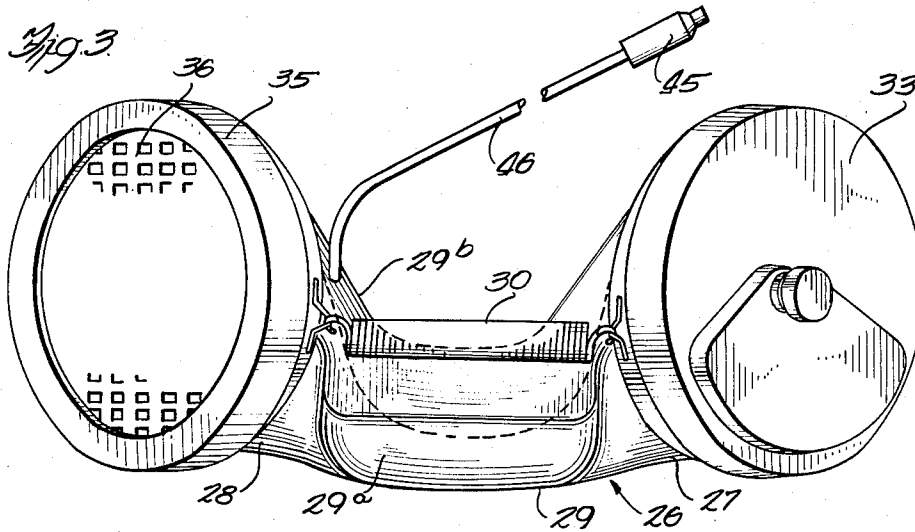
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GAS MASK COMMUNICATION SYSTEM

Filed May 29, 1963

3 Sheets-Sheet 2



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April 27, 1965

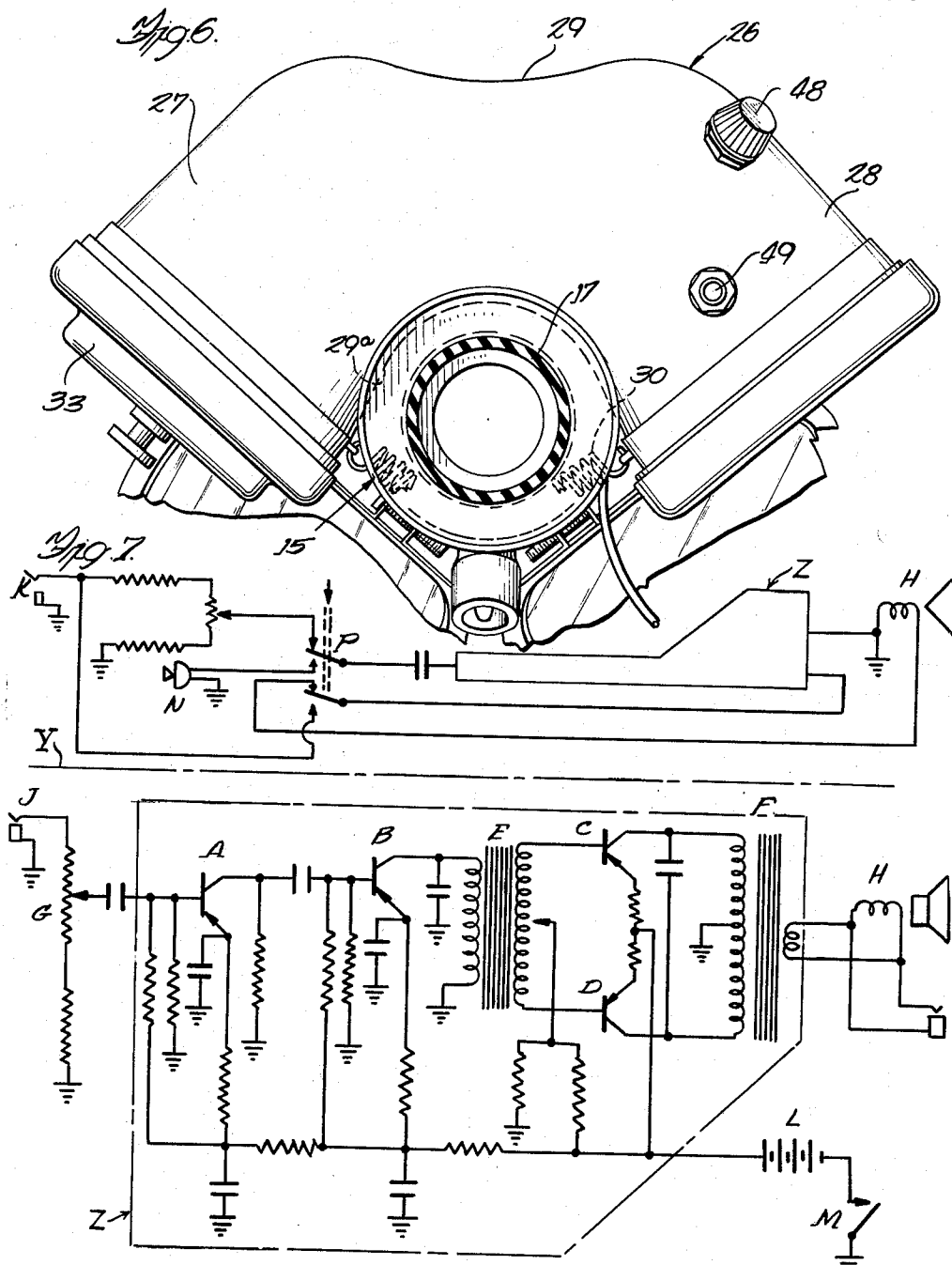
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GAS MASK COMMUNICATION SYSTEM

Filed May 29, 1963

3 Sheets-Sheet 3



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1

3,180,333

GAS MASK COMMUNICATION SYSTEM

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Filed May 29, 1963, Ser. No. 284,179
10 Claims. (Cl. 128—141)

This invention relates to a gas mask communication system, and more particularly to the means for adapting gas masks for amplification of the wearer's voice. The invention also relates to a holder for electrical components of a voice amplification system adapted for use in combination with a gas mask.

It has heretofore been proposed to equip gas masks with voice amplification means whereby the wearer of the mask can communicate with other gas mask wearers, or with control personnel not wearing masks, as may be required when persons at least some of whom are wearing gas masks must cooperate on an industrial or military project. However, in adapting gas masks for voice amplification a number of problems are encountered. For example, it is undesirable to provide attachments for gas masks which interfere with the visibility of the wearer, or which tend to restrict or hamper the freedom of movement of the wearer. An accessory or attachment protruding outwardly from the side or front of a gas mask can be cumbersome, and may have a tendency to cause the mask to separate from the face of the wearer, thereby causing the gas mask to leak. With delicate electrical components, such as those required for a voice amplification system, it is extremely difficult to provide a mounting which avoids the problems discussed above while at the same time adequately protecting the electrical components. Heretofore, these interrelated problems have not been satisfactorily solved, and this has greatly restricted the acceptance of voice amplification means for gas masks, although there is a need for such amplification under many conditions of industrial and military use.

It is, therefore, an object of the present invention to provide a gas mask communication system which substantially overcomes the problems and difficulties described above and which for the first time provides a fully satisfactory means for adapting gas masks for voice amplification. Further objects and advantages will be indicated in the following detailed specification.

The gas mask communication system of this invention is illustrated in the accompanying drawings, in which—

FIGURE 1 is a perspective front view illustrating a gas mask equipped with the communication system of the present invention as it might be worn by a user thereof;

FIGURE 2 is a fragmentary vertical sectional view taken on line 2—2 of FIGURE 1;

FIGURE 3 is a front elevational view of the detached holder;

FIGURE 4 is a top view of the detached holder with portions broken away to show the internal components and other internal components being shown in phantom;

FIGURE 5 is a fragmentary vertical sectional view taken on line 5—5 of FIGURE 4;

FIGURE 6 is a bottom view of the gas mask combination of FIGURE 1 taken on line 6—6 thereof and showing particularly the mounting of the holder containing electrical components of the voice amplification system; and

FIGURE 7 is a circuit diagram for the electrical components of the voice amplifier system.

Looking first at FIGURE 1, the gas mask is designated generally by the number 10, and it includes a face piece 11 for snugly fitting over the face of the wearer. The face piece will usually be formed of a flexible im-

2

pervious material such as natural rubber or other elastomeric material. The outer peripheral portions of the face piece are adapted to conform closely to the face of the wearer, and there is usually provided a chin-conforming portion 12, as shown more clearly in FIGURE 2. Means is also provided for holding the face piece securely on the head of the wearer. In the illustration given, a plurality of adjustable head straps 14 are provided for this purpose.

In accordance with the usual practice, the gas mask is provided with window means to provide maximum visibility for the wearer. In the illustration given, two viewing windows or lenses 13 are provided. If desired, a single viewing window can be used. With the construction shown in FIGURE 1, a flexible strip 11a extends between the windows to permit the further adjustment of the mask to the face of the wearer. Usually, the face pieces of the masks are molded from rubber or other suitable flexible, elastic material.

The gas masks of the kind with which the present invention is adapted to be employed have their lower portions equipped with one or two outwardly-extending tubular extensions which provide air passage means, such as an air inlet, an air outlet, or both an air inlet and an air outlet in one extension. In the illustration given, the tubular extension is indicated generally by the number 15. This can be seen in FIGURES 1 and 2. The extension projects outwardly and downwardly from the lower portion of the face piece 11 over the chin-conforming portion 12. Extension 12 provides passage means therein, such as the passage 16, for supplying air to the face of the wearer. The passage 16 can be connected to a suitable conduit 17, which, in turn, is connected to a source of compressed air or to a suitable gas mask canister into which air is drawn from the surrounding atmosphere. It will be understood that this invention is not limited to the particular type of tubular extension and air passage means shown. For the purpose of the present invention, it is desirable that the tubular extension 15 be at least semi-rigid and substantially less flexible and yielding than face piece 11.

If desired, the tubular extension 15 can also provide an air outlet passage, the inlet and outlet passages being concentrically arranged as with the gas mask of FIGURE 1. The concentric passage arrangement is shown more clearly in FIGURE 2, the outer concentric passage which provides the air outlet passage being designated by the number 18. In the illustration given, the tubular portion 19 is integrally formed with the face piece 11. Within tubular portion 19 there is received a unitary member which includes an outer ring 20 and an inner tube 21 rigidly interconnected by web members 22. Retainer or clamping ring is received over the outside of tube 19 to assist in locking ring 20 in place. The tubular portion 19 terminates in an outer lip 24 which cooperates with a flexible diaphragm valve 25 as received on tube 21. The construction and operation of the concentric inlet and outlets and valve means therefor is described more fully in Patent 2,684,006. Details thereof are not directly connected with the present invention.

As will subsequently be described, the tubular extension, such as extension 15, provides the means for mounting a holder of special construction on the mask, and therefore it is desirable, as already indicated, to have extension 15 sufficiently rigid for this purpose. In the particular illustration given, although tubular portion 19 is formed of flexible material, increased rigidity is supplied by the member providing the ring 20 and tube 21 and the clamping ring 23. Ring 23 can conveniently be formed of metal or plastic, while the inner member which provides the ring 20 and the tube 21 can be molded from a suitable plastic as a one-piece integral unit.

3

In accordance with the present invention, there is provided a holder for electrical components of a voice amplifier system which is detachably mounted on the tubular extension of the mask. In the illustration given, the holder is designated generally by the number 26 and is shown as detachably mounted on the extension 15. As shown more clearly in FIGURES 3, 4, and 6, the holder 26 is characterized by a tubular housing having a generally U-shaped configuration. The housing includes arm portions 27 and 28 and a base portion 29. As shown in FIGURES 1 and 6, the base portion 29 of the holder receives the underside of the extension 15 and the arms 27 and 28 of the U extend outwardly around the tubular extension.

In accordance with the present invention, means is provided for detachably mounting the holder 26 on the extension 15 in the relation just described. For example, there can be provided a strap clamp means which extends between the arms 27 and 28 over the upper side of the extension 15. Preferably, the strap means is releasable or elastic so that the holder can be easily applied or detached. In the illustration given, there is shown an expandable spring 30 which has its outer ends connected by detachable hook and eye means to the outer end portion of the arms 27 and 28, as shown more clearly in FIGURES 3 and 4. With the holder in place, the spring extends around the outer portion of the tubular extension 15 and is sufficiently expanded to securely interlock the holder and extension. This arrangement is shown particularly in FIGURES 1 and 6. For connecting the holder and tubular extension, one end of the spring 30 can be temporarily disconnected and then expanded around the tube as it is reconnected, or the spring can be left connected to both arms and the holder slipped on over the tubular extension with the required expansion of the spring to permit the insertion to be made. It will be understood that other clamping and strap means can be used.

In accordance with the present invention, the holder 26 will contain electrical components of the voice amplification system. Preferably, the holder 26 includes the amplification speaker in one end portion thereof and the batteries for operating the speaker system in the other end portion thereof. In the illustration given, the outer portions of arms 27 and 28 respectively provide mounting receptacles for batteries and for a speaker. As shown in FIGURE 4, a plurality of batteries 31 are supported within arm 27, while a speaker 32 is mounted within arm 28. Preferably, the arm containing the batteries is provided at its outer end with a removable cover, such as the cover 33 on the end of arm 27 and which is removably held in place by means of a nut 34. As can be seen in FIGURE 4, by removing the cover 33, the batteries 31 can be readily replaced. The end of arm 27 is also provided with a cover and which in the illustration given consists of a ring 35 and a grille 36. If desired, the ring 35 and the grille 36 can be made removable, although ordinarily it will not be necessary for the user to obtain access to the speaker 32 during normal operation. Arm 28 also provides a speaker resonance chamber 37, as shown in FIGURE 4. The other electrical components of the system, some of which are also incorporated within the holder 26, will be subsequently described.

It is now desired to describe more particularly one preferred configuration of holder 26. As shown particularly in FIGURES 3-6, the forward wall 29a of the holder base portion 29 is shaped to receive and conform to the underside of the extension 15. In the illustration given, wall 29a and the underside of extension 15 are both of semi-circular shape. It will be understood that wall 29a will usually be of a curved or semi-circular shape when employed with a tubular extension having a circular cross section. The shape of wall 29a can of course be varied to conform to other shapes of tubular extensions.

In the illustration given, the housing base portion 29

4

is provided with an upper surface, such as surface 29b, which has a concave or dished configuration. This permits the base of the holder to extend under the chin portion of the face piece, for example in the manner illustrated in FIGURES 1 and 5. As shown more clearly in FIGURE 5, the chin-conforming portion of the gas mask 12 (shown in dotted lines) is received within the recessed upper surface portion of the holder, and lies in close proximity to the lower portion of the wall 29b. This arrangement assists in stabilizing the mounting of the holder, while permitting the holder to follow movements of the head of the wearer. The wearer can turn his head from side to side, or raise or lower his head without disturbing the mounting of the holder. With extension 15 connecting along the vertical center line of the mask, and the holder arms 27 and 28 extending outwardly on each side thereof, the weight of the holder is evenly balanced.

It will be appreciated by those skilled in the art that the speaker and electrical components contained within holder 26 will be connected to a microphone within face piece 10 so that the voice of the wearer of the mask can be transmitted with appropriate amplification to the speaker. The microphone mounting is shown particularly in FIGURE 2, where the microphone itself is designated by the number 38. Preferably, the microphone is removably mounted. In the illustration given, the microphone is provided as a one-piece assembly, with an arm 39 and a laterally-extending tube 40 which provides a threaded portion 41 for connection with a sleeve 42. As shown in FIGURE 2, the threaded portion 41 extends through an aperture in face piece 11, and is locked thereto by a guard sleeve 42. It will be understood that a gas-tight seal should be maintained, and for this purpose there can be provided an external sealing washer 43a, and an internal sealing ring 43b. As shown ring 43b is integral with face piece 11, but if desired a separate O ring can be used. The microphone assembly also includes a bayonet connector 44 within sleeve 42 for cooperating with a plug jack 45 that connects to a signal-transmitting line 46, as shown more clearly in FIGURE 1. It will be understood that line 46 connects the electrical components within holder 26.

With the construction just described, microphone 38 and the associated components, together with holder 26, can be readily removed from the gas mask. This is important, since gas masks frequently must be subjected to cleaning, sterilization, or decontamination, and these processes would be injurious for the voice amplification system components.

Since the wearer of the mask will usually not wish to have the speaker in operation at all times, the speaker system may be provided with an on and off switch, which should be conveniently located for use by the wearer of the mask. With the construction of this invention, the on and off switch may be mounted on the holder 26, for example, on one of the arms thereof. In the illustration given, an on-off switch 47 is mounted within the resonance chamber 37 in the arm 28, and is operated by means of a knob 48 on the outside of the arm. Operating knob 48 can also provide a volume control for the speaker, as is well-known in the voice amplification art.

Where desired, suitable connections and wiring extensions can be provided for other speakers in parallel with speaker 32. The other speakers may be in a master unit, or in similar holders of other gas masks. For example, arm 28 can be provided with a plug-in connector 49, as shown more clearly in FIGURES 4 and 6. A signal-transmitting line 50, with a suitable plug 51, can be attached to connector 49. As shown in FIGURE 1, cord 50 can extend to a plug 52 on the belt of the wearer, which in turn connects to a plug 53 with a signal-transmitting cord 54 that extends to a master unit 55.

The master unit would be used, for example, by a

5

foreman of a tank cleaning crew. The foreman would be outside of the tank and thus would not be wearing a gas mask, while one or more workers within the tank would be equipped with gas masks of the type previously described having the voice amplification system. The system would be wired so that the voice of each wearer of a gas mask would be transmitted to the speaker of the master unit, and to the speakers of all other masks connected therewith. The master unit 55 would also contain a microphone immediately behind the grill 56 at one end thereof, the microphone being immediately in front of the speaker. By turning a control switch 57, the operator of the master unit could cut out the speaker and cut in the microphone. The microphone would be wired so that when the operator of the master unit spoke into it, the voice would be transmitted to the speakers of each of the gas masks, and amplified thereover. Alternatively, two or more gas mask voice amplification systems can be interconnected without the use of a master unit. Each gas mask unit would power the speakers of all the other gas masks.

As indicated in FIGURE 4, other electrical components of the voice amplification system can be included within holder 26. For example, transistor amplifier components and associated wiring, as indicated generally by the number 58, can be positioned within the central portion of the holder. To prevent dislodging and damage of these components, they can be embedded within cast-in-place packing material, such as a rigid polyurethane foam. The foam-type packing can also be used around the mounting for the batteries 31. In FIGURE 4, the foam material 59 is shown around the battery case 60 within arm 27.

An illustrative circuit diagram for the system is shown in FIGURE 7. The circuit is relatively conventional, and no claim to its novelty is made apart from the combination of the present invention. The upper portion of the diagram (above the broken line Y) is the circuit for the master unit, while the portion below line Y is the circuit for the mask unit. It will be understood that both circuits include the elements enclosed within the box Z of the mask unit circuit, which is indicated in block form in the master unit circuit and designated by the same letter. The operation of the circuit may be briefly described as follows:

Sounds picked up by the microphone 38 are transmitted to the amplifier through input jack J to volume control G, then through transistor input stage A to the driver stage consisting of transistor B and driver transformer E, then to the output stage consisting of push-pull transistors C and D and output transformer F. The center tap on the secondary winding of transformer E supplies bias voltage to transistors C and D. The secondary winding of F is connected to speaker H and remote jack K. Power is supplied by a battery L and controlled by an on-off switch M.

The master unit includes microphone N and is electrically identical to the mask unit except for the addition of a transmit-receive switch P. In operation, the master unit is wired as a receiver monitoring the sound coming from one or more mask units by wired connections between the jack K on all units. When the master wishes to talk to the mask units, he pushes the switch P to the transmit position. This reconnects the unit as a transmitter and sends the signal from the master microphone N through the master amplifier and back through the wires to the jacks K and the speakers H of the mask units.

When more than one mask units are wired together between jacks K, all sounds picked up from any mask unit microphone N will be heard through all mask unit speakers H.

While in the foregoing specification this invention has been described with respect to a specific embodiment thereof, and a number of preferred features have been

6

discussed with respect to this embodiment, it will be apparent to those skilled in the art that the invention is susceptible to other embodiments and that certain of the features described herein can be omitted or varied without departing from the broader aspects of the present invention.

I claim:

1. In combination with a gas mask face piece equipped with a tubular extension providing air passage means therein and projecting outwardly from the lower portion of said face piece, a holder mounted on said extension, electrical components of a voice amplifier system supported within said holder, said holder being characterized by a tubular housing having a generally U-shaped configuration, the base portion of said U receiving the underside of said extension and the arms of said U extending outwardly around said tubular extension, and means being provided for securing said arms around said tubular extension.

2. The combination of claim 1 wherein the outer end portions of said housing arm portions interiorly provide respectively mounting receptacles for a voice amplifying speaker and batteries for powering said speaker, and wherein a cover is removably mounted on the outer end of said arm providing said battery mounting.

3. In combination with a gas mask face piece having face-conforming peripheral portions including a chin portion, said face piece being equipped with a tubular extension providing air passage means therein and projecting outwardly from the lower portion of said face piece, over said chin portion, a holder mounted on said extension, electrical components of a voice amplifier system supported within said holder, said holder being characterized by a tubular housing having a generally U-shaped configuration, the base portion of said U receiving the underside of said extension and the arms of said U extending outwardly around said extension, said housing base portion having an upper surface extending to a position beneath the said chin portion of said mask.

4. The combination of claim 3 wherein the outer end portions of said housing arm portions interiorly provide respectively mounting receptacles for a voice amplifying speaker and batteries for powering said speaker, and wherein a cover is removably mounted on the outer end of said arm providing said battery mounting.

5. In combination with a gas mask face piece formed of a flexible material and equipped with a relatively rigid tubular extension providing air passage means therein and projecting outwardly and downwardly from the lower portion of said face piece, a holder detachably mounted on said extension, electrical components of a voice amplifier system supported within said holder, said holder being characterized by a tubular housing having a generally U-shaped configuration, the base portion of said U receiving and conforming to the underside of said extension, and the arms of said U extending outwardly around said tubular extension, said housing base portion having an upper surface extending to a position beneath the lower end of said face piece, said upper surface having a concave configuration, and means being provided for removably securing said holder arms around said tubular extension.

6. The combination of claim 5 wherein said face piece is also provided with a removably mounted microphone, and signal conductor means is detachably connected between said microphone and said holder, whereby said microphone, said signal conductor means, and said holder can be readily removed from said face piece.

7. In combination with a gas mask face piece having face-conforming peripheral portions including a chin portion, said face piece being equipped with a tubular extension providing air passage means therein and projecting outwardly from the lower portion of said face piece over said chin portion, said tubular extension being relatively rigid compared to said face piece, a holder detachably mounted on said extension, electrical components

of a voice amplifier system supported within said holder, said holder being characterized by a tubular housing having a generally U-shaped configuration, the base portion of said U receiving and conforming to the underside of said extension and the arms of said U extending outwardly around said extension, said housing base portion having an upper surface extending to a position beneath the said chin portion of said mask, said upper surface having a dished configuration to permit said surface to be disposed in close proximity to said chin-conforming portion of said mask.

8. The combination of claim 7 wherein said holder is detachably mounted on said extension by releasable strap means extending between the outer end portions of the arms of said U over the upper side of said extension.

9. The combination of claim 8 wherein the outer end portions of said housing arm portions interiorly provide respectively mounting receptacles for a voice amplifying speaker and batteries for powering said speaker, and wherein a cover is removably mounted on the outer end of said arm providing said battery mounting.

10. In combination with a gas mask face piece formed of a flexible material and equipped with a tubular extension providing air passage means therein and project-

ing outwardly and downwardly from the lower portion of said face piece, said air passage means including concentric air supply and discharge passages and said tubular extension being relatively rigid compared to said face piece, a holder detachably mounted on said extension, electrical components of a voice amplifier system supported within said holder, said holder being characterized by a tubular housing having a generally U-shaped configuration, the forward wall of the base portion of said U receiving and conforming to the underside of said extension and the arms of said U extending outwardly around said tubular extension, said housing base portion having an upper surface extending to a position beneath the lower end of said face piece.

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